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THOMAS, KAYDEN, HORSTEMEYER & RISLEY, LLP
100 GALLERIA PARKWAY, NW
STE 1750
ATLANTA, GA 30339-5948

EXAMINER

HSU, JONI

ART UNIT	PAPER NUMBER
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2628

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/17/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/729,684	Applicant(s) HONG ET AL.	
	Examiner Joni Hsu	Art Unit 2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 October 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>8/28/06</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on August 28, 2006 was filed after the mailing date of the application on December 5, 2003. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Response to Amendment

2. In light of Applicant's amendments to Claims 1, 8, and 13, the 35 U.S.C. 101 rejections have been withdrawn.

3. Applicant's arguments filed October 27, 2006 have been fully considered but they are not persuasive.

4. With regard to Gannett (US006118452A), Applicant argues that Gannett does not teach passing only a limited set of graphic data for each primitive on a first pass (pages 11-16, 19, 20).

In reply, the Examiner disagrees. Gannett discloses passing a fragment on a first pass through the visibility pretest module 202 to determine whether the fragment will be visible, and the performing a second pass (*the span is traversed once during processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen, the span is traversed a second time during the subsequent per-fragment*

operations, and only for those spans which have at least one visible fragment, Col. 13, line 65-Col. 14, line 5). During this second pass, the first and succeeding fragments are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150 (*upon the completion of the visibility pretest, the first and succeeding fragments in the current span are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150*, Col. 14, line 66-Col. 15, line 3). Therefore, since more fragments are selected to be passed in the second pass than in the first pass, this means that only a limited set of graphics data for each primitive is passed on a first pass.

5. With regard to Greene (US005579455A), Applicant argues that Greene does not teach of a compressed z-buffer comprising a plurality of z-records, each containing z information for multiple pixels (pages 16-18).

In reply, the Examiner disagrees. According to the disclosure of this application, a compressed z-buffer effectively provides condensed depth information for multiple pixels, such that a grouping of pixels (or a macro-pixel) may be trivially accepted if all pixels of a current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all pixels of the current macro-pixel primitive are deemed to be behind previously-stored pixels [0023]. Greene discloses that if it is determined that each pixel (all pixels) of the macro-pixel (cube) is behind the current surface in the Z-buffer (previously-stored pixels), all the geometry contained in that macro-pixel can safely be ignored (trivially rejected) (Col. 4, lines 30-37). Therefore, it does appear that Greene discloses a compressed z-buffer comprising a plurality of z-records,

each containing z information for multiple pixels, according to this description in the disclosure of this application.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 8-11, 21, 23, 25, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Gannett (US006118452A).

8. With regard to Claim 8, Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of graphic data for each span is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment operations are performed on these primitives. Gannett discloses that each primitive is converted into fragments (*vertex data 152 enters the primitive assembly processing stage 160 wherein the*

vertices are converted into primitives, Col. 7, lines 12-14; *in the rasterization processing stage 164, geometric data 152 is converted into fragments*, Col. 7, lines 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Gannett discloses passing a fragment on a first pass through the visibility pretest module 202 to determine whether the fragment will be visible, and the performing a second pass (Col. 13, line 65-Col. 14, line 5). During this second pass, the first and succeeding fragments are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150 (Col. 14, line 66-Col. 15, line 3). Therefore, since more fragments are selected to be passed in the second pass than in the first pass, this means that only a limited set of graphics data for each primitive is passed on a first pass. Therefore, Gannett describes a method of rendering a plurality of graphic primitives comprising passing, within a graphic pipeline (Col. 3, lines 15-30; Col. 6, lines 6-9), only a limited set of graphic data for each primitive, wherein each primitive comprises a plurality of pixels; processing the limited set of graphic data (Col. 13, lines 55-59; Col. 13, line 65-Col. 14, line 9); determining, for each primitive, whether the primitive has at least one visible pixel (Col. 13, line 65-Col. 14, line 5); communicating data associated with pixels of primitives determined to have at least one visible primitive to a pixel shader for rendering (*fragment operations stage 168, fog calculations may be applied at module 210, adding fog which makes the objects shade*

into the distance, Col. 8, lines 43-51; *per-fragment operations include fog operations*, Col. 15, lines 13-22; *span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment*, Col. 14, lines 3-5); and processing, within the pixel shader, a full set of graphic data for only those primitives determined to have at least one visible pixel (Col. 13, line 65-Col. 14, line 5).

9. With regard to Claim 9, Gannett describes setting a visibility indicator for each pixel determined to have at least one visible pixel (*visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22; *indicating whether a pixel associated with each fragment will not be visible*, Col. 3, lines 46-55).

10. With regard to Claim 10, Gannett describes that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory (*visible pretest module 202 receiving the various clear control commands and values from the frame buffer*, Col. 13, lines 16-19; Col. 14, lines 13-22).

11. With regard to Claim 11, Gannett describes that the processing only a limited set of graphic data more specifically comprises processing only location-related data (Col. 13, lines 50-55; Col. 14, lines 35-44).

12. With regard to Claim 21, Gannett discloses that in the first pass the span is traversed during the processing performed by the visibility pretest module 202 to determine the visibility of the pixels to determine which spans have no visible pixels and eliminates the processing of spans that have no visible pixels (Col. 13, line 65-Col. 14, line 9), the first pass has logic configured to limit the processing of graphic data for each of the plurality of primitives. In the second pass within the graphic pipeline, only the spans determined in the first pass to have at least one visible pixel are rendered (Col. 14, lines 3-9). Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Gannett discloses passing a fragment on a first pass through the visibility pretest module 202 to determine whether the fragment will be visible, and the performing a second pass (Col. 13, line 65-Col. 14, line 5). During this second pass, the first and succeeding fragments are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150 (Col. 14, line 66-Col. 15, line 3). Therefore, since more fragments are selected to be passed in the second pass than in the first pass, this means that only a limited set of graphics data for each primitive is passed on a first pass. Therefore, Gannett describes a graphics processor comprising logic configured to process only a limited set of graphic data passed into a graphic pipeline for each of a plurality of primitives, in a first pass

within the graphic pipeline (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9), to determine whether the primitive has at least one visible pixel (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22), wherein each primitive comprises a plurality of pixels (Col. 13, lines 55-59); logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel (Col. 13, line 60-Col. 14, line 9).

13. With regard to Claim 23, Gannett describes that the logic configured to limit the processing of graphic data is within a parser (114, Figure 1A; Col. 13, lines 50-55).

14. With regard to Claim 25, Gannett describes logic for setting a visibility indicator for each primitive processed in the first pass (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22).

15. With regard to Claim 26, Gannett describes logic configured to evaluate the visibility indicator for each primitive prior to submitting the primitive to the logic configured to render in the second pass (Col. 13, line 60-Col. 14, line 9).

16. Thus, it reasonably appears that Gannett describes or discloses every element of Claims 8-11, 21, 23, 25, and 26 and therefore anticipates the claims subject.

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

19. Claim 1-3, 6, 7, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Gannett (US006118452A) in view of Greene (US005579455A).

20. With regard to Claim 1, Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of

graphic data for each span is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment operations are performed on these primitives. Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Gannett discloses passing a fragment on a first pass through the visibility pretest module 202 to determine whether the fragment will be visible, and the performing a second pass (Col. 13, line 65-Col. 14, line 5). During this second pass, the first and succeeding fragments are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150 (Col. 14, line 66-Col. 15, line 3). Therefore, since more fragments are selected to be passed in the second pass than in the first pass, this means that only a limited set of graphics data for each primitive is passed on a first pass. Therefore, Gannett describes a multi-pass method of rendering a plurality of graphic primitives comprising in a first pass: passing only a limited set of graphic data for each primitive through a graphic pipeline (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9); processing the limited set of data to build a z-buffer, the z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (302, Figure 3; Col. 12, lines 4-13; Col.

9, lines 35-43); setting a visibility indicator, for each primitive, if any pixel of the primitive is determined to be visible (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22); in a second pass: for each primitive, determining whether the associated visibility indicator for that primitive is set; discarding, without passing through the graphic pipeline, the primitives for which the associated visibility indicator is not set; passing a full set of graphic data for each primitive determined to have the associated visibility indicator set (Col. 13, line 60-Col. 14, line 9); and performing a z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the z-buffer (222, Figure 2; Col. 12, lines 4-13; Col. 9, lines 35-43); and communicating data associated with pixels determined to be visible to a pixel shader for rendering (Col. 8, lines 43-51; Col. 15, lines 13-22; Col. 14, lines 3-5).

However, Gannett does not teach that the z-buffer is a compressed z-buffer and performing a two-level z-test. However, Greene describes a multi-pass method of rendering a plurality of graphic primitives comprising in a first pass: passing a set of graphic data for each primitive through a graphic pipeline (Col. 4, lines 38-49). According to the disclosure of this application, a compressed z-buffer effectively provides condensed depth information for multiple pixels, such that a grouping of pixels (or a macro-pixel) may be trivially accepted if all pixels of a current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all pixels of the current macro-pixel primitive are deemed to be behind previously-stored pixels [0023]. Greene discloses that if it is determined that each pixel (all pixels) of the macro-pixel (cube) is behind the current surface in the Z-buffer (previously-stored pixels), all the geometry

contained in that macro-pixel can safely be ignored (trivially rejected) (Col. 4, lines 30-37).

Therefore, Greene discloses a compressed z-buffer comprising a plurality of z-records, each containing z information for multiple pixels, according to this description in the disclosure of this application. Greene describes processing the set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (Col. 4, lines 30-37; Col. 5, lines 51-61); in a second pass: discarding, without passing through the graphic pipeline, the primitives that are not visible (Col. 4, lines 43-46); passing a set of graphic data for each primitive that are visible; and performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of an associated macropixel are visible (Col. 4, lines 46-49; Col. 6, lines 20-36).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Gannett so that the z-buffer is a compressed z-buffer and performing a two-level z-test as suggested by Greene because Greene suggests the advantage of rejecting hidden geometry very quickly and having an algorithm which is much faster than traditional ray-casting or z-buffering (Col. 3, line 61-Col. 4, line 4).

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21. With regard to Claim 2, Gannett describes that passing only a limited set of graphic data more specifically comprises passing only location-related data through the pipeline (Col. 13, lines 50-55; Col. 14, lines 35-44).

22. With regard to Claim 3, Gannett describes that location-related data comprises X, Y, Z and W values (Col. 1, lines 29-33; Col. 13, lines 50-55).

23. With regard to Claim 6, Gannett describes that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory (Col. 13, lines 16-19; Col. 14, lines 13-22).

24. With regard to Claim 7, Gannett describes that the discarding is performed by a parser (202, Figure 2; Col. 10, lines 36-38).

25. With regard to Claim 13, Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of graphic data for each span is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment

operations are performed on these primitives. Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Gannett discloses passing a fragment on a first pass through the visibility pretest module 202 to determine whether the fragment will be visible, and the performing a second pass (Col. 13, line 65-Col. 14, line 5). During this second pass, the first and succeeding fragments are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150 (Col. 14, line 66-Col. 15, line 3). Therefore, since more fragments are selected to be passed in the second pass than in the first pass, this means that only a limited set of graphics data for each primitive is passed on a first pass. Therefore, Gannett describes a method of rendering a plurality of graphic primitives comprising passing in a first pass, within a graphic pipeline, only a limited set of graphic data for each primitive (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9), wherein each primitive comprises a plurality of pixels (Col. 13, lines 55-59); processing the limited set of data to build a z-buffer, the z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43); in a second pass, within the graphic pipeline, performing a z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the

compressed z-buffer (222, Figure 2; Col. 12, lines 4-13; Col. 9, lines 35-43); and communicating data associated with pixels determined to be visible to a pixel shader for rendering (Col. 8, lines 43-51; Col. 15, lines 13-22; Col. 14, lines 3-5).

However, Gannett does not teach that the z-buffer is a compressed z-buffer and performing a two-level z-test. However, Greene describes a multi-pass method of rendering a plurality of graphic primitives comprising in a first pass: passing a set of graphic data for each primitive through a graphic pipeline (Col. 4, lines 38-49). According to the disclosure of this application, a compressed z-buffer effectively provides condensed depth information for multiple pixels, such that a grouping of pixels (or a macro-pixel) may be trivially accepted if all pixels of a current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all pixels of the current macro-pixel primitive are deemed to be behind previously-stored pixels [0023]. Greene discloses that if it is determined that each pixel (all pixels) of the macro-pixel (cube) is behind the current surface in the Z-buffer (previously-stored pixels), all the geometry contained in that macro-pixel can safely be ignored (trivially rejected) (Col. 4, lines 30-37). Therefore, Greene discloses a compressed z-buffer comprising a plurality of z-records, each containing z information for multiple pixels, according to this description in the disclosure of this application. Greene describes processing the set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (Col. 4, lines 30-37; Col. 5, lines 51-61); in a second pass: discarding, without passing through the graphic pipeline, the primitives that are not visible (Col. 4, lines 43-46); passing a set of graphic data for each primitive that are visible; and performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current

primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of a macropixel are visible (Col. 4, lines 46-49; Col. 6, lines 20-36), as discussed in the rejection for Claim 1.

26. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Gannett (US006118452A) and Greene (US005579455A) in view of Duluk (US006476807B1).

27. With regard to Claim 4, Gannett and Greene are relied upon for the teachings as discussed above relative to Claim 1. Gannett describes that each z-record comprises a coverage mask, the coverage mask indicating which of the plurality of pixels are visible for the current primitive (318, Figure 3; *sets or clears the bit in the fragment visibility mask 318 associated with each fragment in accordance with whether the fragment passed or failed all the visibility pretests incorporated in the pretest modules 301*, Col. 14, lines 13-22; Col. 12, lines 4-21; Col. 3, lines 46-50).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Greene describes that the z-buffer is a compressed z-buffer (Col. 4, lines 30-37; Col. 5, lines 51-61), as discussed in Claim 1.

However, Gannet and Greene do not teach that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels. However,

Duluk describes that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels (Col. 31, lines 45-57).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the devices of Gannett and Greene so that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels as suggested by Duluk because Duluk suggests that this is needed in order to have an accurate z value. With an accurate z it is known that the z value represents a surface that is known to be visible and anything in front of it is visible and everything behind it is obscured, at that point in the process (Col. 31, lines 36-63).

28. With regard to Claim 5, Gannett describes that each z-record comprises a coverage mask, the coverage mask indicating which of the plurality of pixels are visible for the current primitive (318, Figure 3; Col. 14, lines 13-22; Col. 12, lines 4-21; Col. 3, lines 46-50).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Greene describes that the z-buffer is a compressed z-buffer (Col. 4, lines 30-37; Col. 5, lines 51-61) and performing a two-level z-test (Col. 4, lines 46-49; Col. 6, lines 20-36), as discussed in Claim 1.

However, Gannett and Greene do not teach that each compressed z-record comprises two minimum z values for the plurality of pixels and two maximum z values for the plurality of pixels. However, Duluk describes that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels for the z-test (Col. 31, lines 45-57). Combining Duluk with Greene, which teaches performing a two-level z-test, it would be

obvious to modify the device of so that each compressed z-record comprises two minimum z values for the plurality of pixels and two maximum z values for the plurality of pixels. This would be obvious for the same reasons given in the rejection for Claim 4.

29. Claims 12, 14-20, 22, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Gannett (US006118452A) in view of Griffin (US005990904A).

30. With regard to Claim 12, Gannett is relied upon for the teachings as discussed above relative to Claim 8. Gannett describes that the determining whether the primitive has at least one visible pixel ensures that the primitive does not fail a z-buffer test (Col. 9, lines 35-43; Col. 12, lines 4-21), ensures that all pixels of the primitive are not culled, and ensures that all pixels of the primitive are not clipped (Col. 7, lines 24-38).

However, Gannett does not teach a compressed z-buffer and ensuring that the primitive does not render to zero pixels. According to the disclosure of this application, a zero-pixel primitive is a primitive that, when rendered, consumes less area than one pixel of visibility [0024]. Griffin describes a compressed z-buffer (Col. 9, lines 34-54) and ensuring that the primitive does not render to zero pixels (Col. 2, line 61-Col. 3, line 5; Col. 5, lines 26-42).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Gannett to include ensuring that the primitive does not render to zero pixels as suggested by Griffin because Griffin suggests the advantage of being able to perform anti-aliasing to that anomalies such as jaggy edges in the rendered image do not result (Col. 2, line 61-Col. 3, line 5). It would have been obvious to modify the device to include a

compressed z-buffer because Griffin suggests the advantage of considerably reducing the amount of data required, allowing practical implementation of a much more sophisticated anti-aliasing algorithm (Col. 9, lines 34-54).

31. With regard to Claim 14, Gannett does disclose a system that is structured to perform a two-pass graphics processing approach (Col. 13, line 65-Col. 14, line 9). Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Since this is done for each span in each primitive, the operation is determining, for each primitive, whether the primitive has at least one visible pixel. Gannett discloses passing a fragment on a first pass through the visibility pretest module 202 to determine whether the fragment will be visible, and the performing a second pass (Col. 13, line 65-Col. 14, line 5). During this second pass, the first and succeeding fragments are selected to be processed through the per-fragment operation stage 168 of the graphics pipeline 150 (Col. 14, line 66-Col. 15, line 3). Therefore, since more fragments are selected to be passed in the second pass than in the first pass, this means that only a limited set of graphics data for each primitive is passed on a first pass. Therefore, Gannett describes a graphics processor comprising first-pass logic configured to deliver to a graphic pipeline, in a first pass,

only a limited set of graphic data for each primitive (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9), wherein each primitive comprises a plurality of pixels (Col. 13, line 65-Col. 14, line 9); logic configured to process the limited set of graphic data for each primitive to create a z-buffer (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43); logic configured to determine, for each primitive, whether the primitive has at least one visible pixel (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22); second-pass logic configured to deliver to the graphic pipeline, in a second pass, a full set of graphic data for only those primitives determined to have at least one visible pixel, the second-pass logic further configured to inhibit the delivery of graphic data to the graphic pipeline for primitives not determined to have at least one visible pixel (Col. 13, line 60-Col. 14, line 9).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Griffin describes that the z-buffer is a compressed z-buffer (Col. 9, lines 34-54), as discussed in the rejection for Claim 12.

32. With regard to Claim 15, Gannett describes that the first-pass logic and second-pass logic are contained within a parser (202, Figure 2; Col. 13, line 60-Col. 14, line 9).

33. With regard to Claim 16, Claim 16 is similar in scope to Claim 12, and therefore is rejected under the same rationale.

34. With regard to Claim 17, Gannett describes logic for setting a visibility indicator for each primitive determined to have at least one visible pixel (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22).

35. With regard to Claim 18, Gannett describes that the visibility indicator includes a single bit in a frame-buffer memory (Col. 13, lines 16-19; Col. 14, lines 13-22).

36. With regard to Claim 19, Gannett describes logic configured to associate each primitive processed in the first pass of the data with a distinct visibility indicator (Col. 14, lines 18-22).

37. With regard to Claim 20, Gannett describes logic configured to evaluate, for each primitive presented for processing in the second pass, a status of the visibility indicator associated with the given primitive (Col. 13, line 60-Col. 14, line 9).

38. With regard to Claim 22, Claim 22 is similar in scope to Claim 12, and therefore is rejected under the same rationale.

39. With regard to Claim 24, Gannett describes logic configured to build a z-buffer of data from processing of the graphic data in the first pass (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Griffin describes that the z-buffer is a compressed z-buffer (Col. 9, lines 34-54), as discussed in the rejection for Claim 12.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joni Hsu whose telephone number is 571-272-7785. The examiner can normally be reached on M-F 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JH


ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER